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(56) Documents Cited

**GB 2287731 A EP 0624709 A2**  
**WO 2001/049967 A1 WO 2001/029373 A1**  
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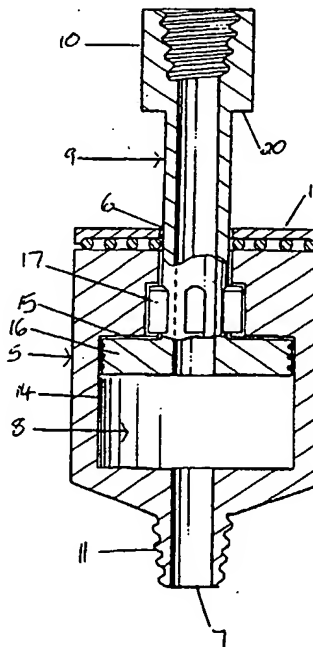
(58) Field of Search

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(54) Abstract Title

**Torque isolation mechanism**

(57) A torque isolation mechanism is provided between sections of drill string and comprises first and second body portions 5, 9, each connected to one end of a section of drill pipe. A bore 7 passes through both portions and a clutch mechanism is provided around the bore, selectively decoupling the sections of drill pipe so that they are free to rotate independently of each other. The clutch mechanism comprises a cavity 8 within the first body portion and radially extending splines 17 on the second portion that engage with complementary recesses (13, figure 3) around the periphery of a neck in the cavity. Compressive axial movement of the body portions moves the splines out of engagement and allows relative rotation. A radially extending flange 16 on the second body portion limits axial motion by abutting against an end of the cavity when the clutch is fully engaged or disengaged. The invention allows release of rotational stress from the drill string.



*Figure 2*

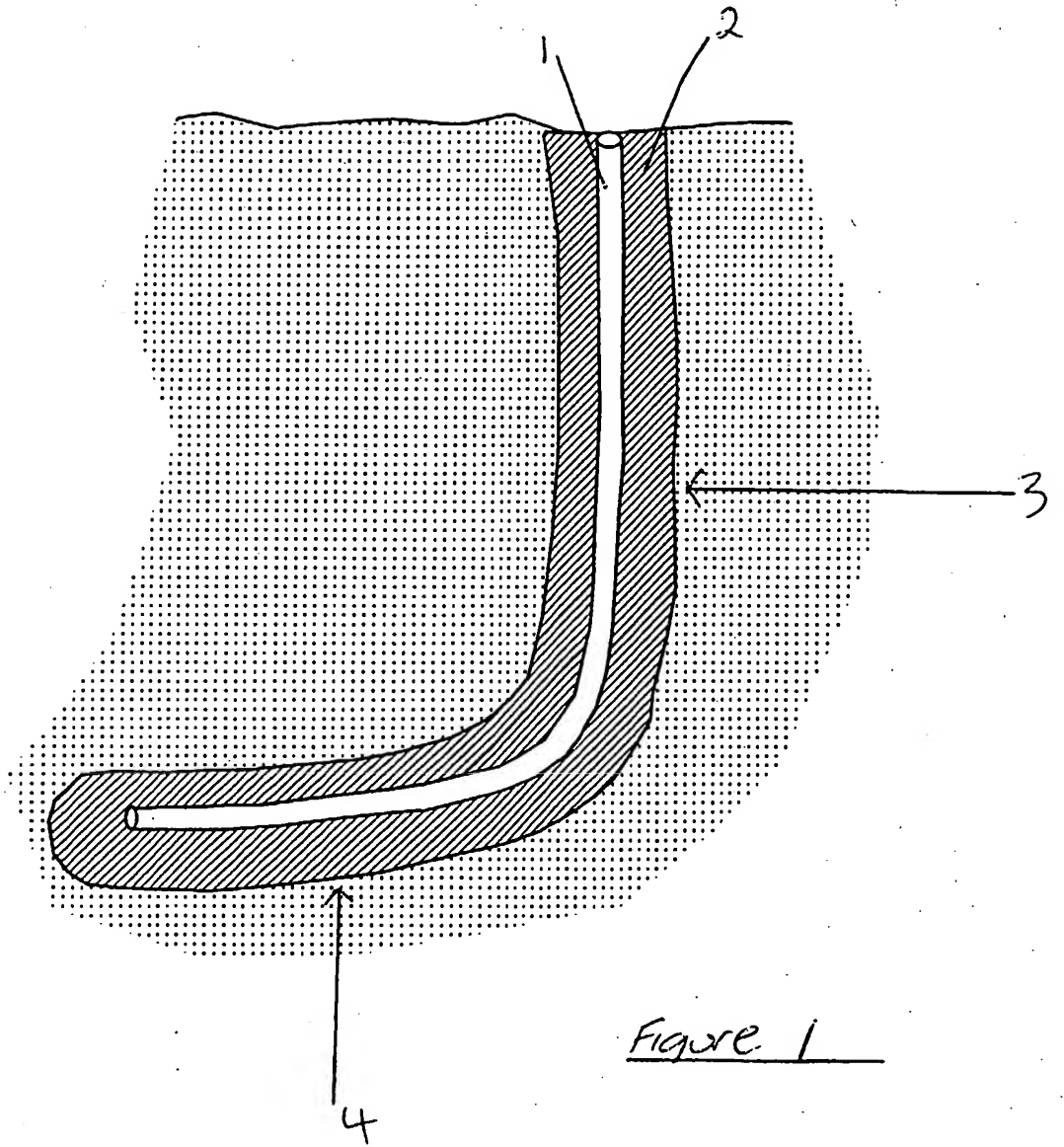


Figure 1

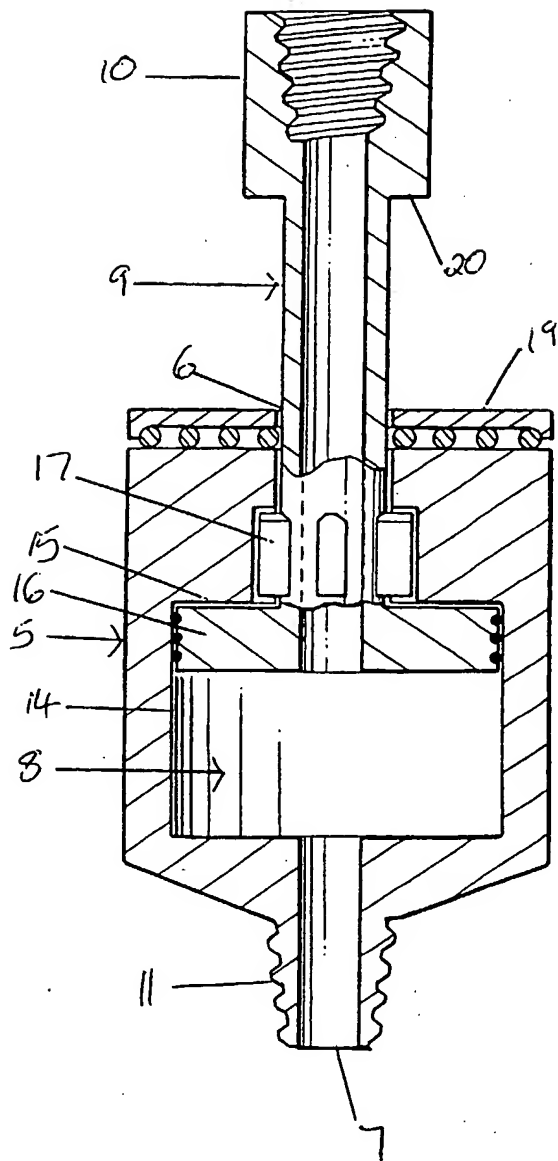


Figure 2

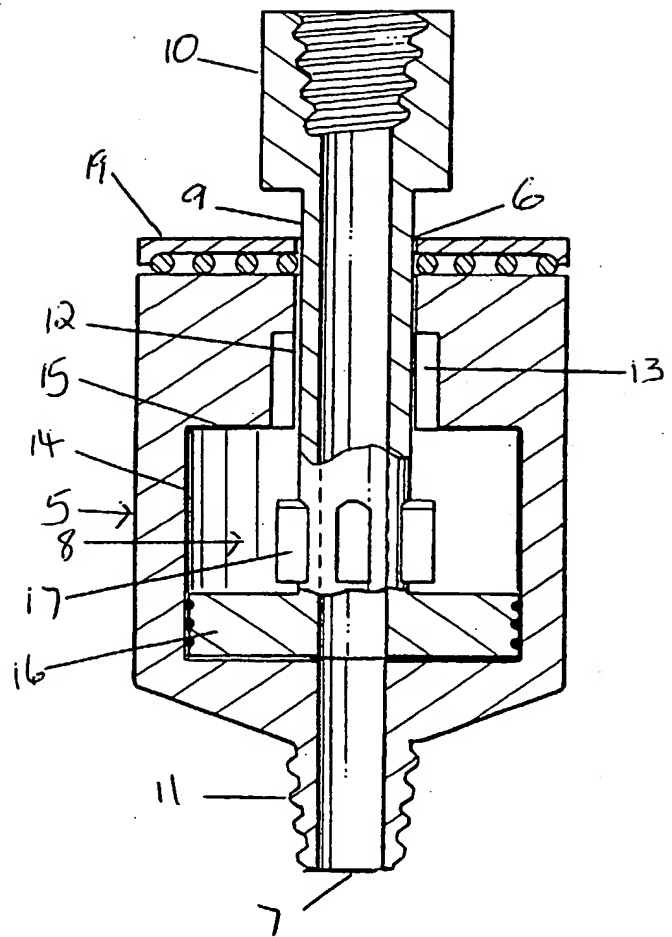


Figure 3

DESCRIPTION"A TORQUE ISOLATION MECHANISM"

The present invention relates to a torque isolation mechanism. More specifically  
5 the present invention relates to a torque isolation mechanism for use in a drill pipe string.

It is known to clean oil and gas well bores by pumping cleaning fluids into the  
well bore through a drill pipe string. It is not unusual for the path taken by a well bore  
through the ground to include inclined and even horizontal runs and, as a consequence  
of these, the drill string is required to bend and twist as it is introduced into the well bore.  
10 These bends and twists introduce torsional strains in the drill string.

It is an object of the present invention to provide a torque isolation mechanism  
for use in a drill pipe string which enables sections of the drill pipe string on each side  
of the mechanism to be effectively disconnected from one another, thereby releasing any  
torsional forces which have developed between them.

15 According to the present invention there is provided a torque isolation mechanism  
having a first end and a second end, each adopted, in use, to be connected to one end of  
a respective section of drill pipe string, and a through bore extending between the first  
end and the second end, wherein a clutch mechanism is provided between the said first  
and second ends, whereby when the clutch mechanism is engaged the said ends are  
20 rotatably connected together and when the clutch mechanism is disengaged the said ends  
are rotatably disconnected from each other such that each section of drill pipe string is  
isolated from the other and free to rotate independently thereof.

It will be understood that the through bore in the torque isolation mechanism ensures that cleaning fluid is able to pass freely between the two sections of drill pipe string, whilst the clutch mechanism enables any torsional strains which have developed in the sections as the drill pipe string passes through a well bore to be released.

5           Conveniently, the clutch mechanism is caused to disengage by externally supporting the weight of the lowermost of the two sections of drill pipe string and causing the uppermost to be lowered relative thereto. In practice the lowermost section is supported on the well bottom, or on inclined or horizontally extending surfaces of the well bore.

10           In a preferred embodiment of the present invention the clutch mechanism comprises an outer body member having a cylindrical cavity therein and openings at each end of the cavity, and a tubular shaft member one end of which is coaxially received within the said cylindrical cavity through one of the said end openings, wherein mutually engageable locking members are provided on the inner surface of the said cylindrical  
15           cavity and on the outer surface of the inner end of the said tubular shaft, and wherein the tubular shaft member is slidable axially within the said cylindrical cavity between a first position in which the said locking members are engaged, thereby preventing rotation of the outer body member relative to the tubular shaft member, and a second axially removed position in which the locking members are disengaged, thereby enabling the  
20           outer body member to rotate relative to the tubular shaft member.

Conveniently the said mutually engageable locking members comprise internal and external axially extending splines. Preferably, the inner surface of the said

cylindrical cavity defines a radially outwardly extending lip against which a radially outwardly extending surface of the said shaft member engages to retain the shaft member in the said cylindrical cavity. In addition, a sealing member, for example, O-rings, may be provided between the said shaft member and the said cylindrical cavity to prevent  
5 cleaning fluid leaking past the shaft member and out of the opening in the said outer body member in which it is received.

Preferably, the free end of both the shaft member and of the outer body member is adapted for connection to the end of a section of drill pipe string. Conveniently, the torque isolation mechanism comprises a thrust race on which the uppermost part thereof  
10 rests when the clutch mechanism is in the second disengaged position which serves to facilitate relative rotation of the two parts of the clutch mechanism.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows schematically a drill pipe string in a well bore;

15 Figure 2 shows a partial sectional view of a torque isolation assembly according to the present invention with the respective ends thereof connected; and

Figure 3 shows a partial sectional view of the torque isolation assembly shown in Figure 2 with the respective ends thereof disconnected and free to rotate relative to one another.

20 Referring to Figure 1 of the drawings there is shown a schematic view of a drill pipe string 1 in a well bore 2. In order to clean the inner surface of the well bore 2 cleaning fluid is pumped through the drill pipe string 2 from the surface of the well bore

2. It will be seen that the well bore 1, as is frequently the case, does not extend vertically into the ground for its full length, but rather it comprises a first vertical section 3 and a second horizontal section 4. More complex paths are known for well bores.

As the drill pipe string 1 follows the path of the well bore 2 into the ground it has to bend and curve, and this introduces torsional strains in it. Over a period of time this may cause damage to the drill pipe string 1. It would, therefore, be desirable to release these torsional strains whilst the drill pipe string 1 is in the well bore 2.

In Figure 2 of the drawings there is shown a torque isolation mechanism comprising an outer body member 5 having an opening 6, 7 in each end into a cylindrical cavity 8, and a tubular shaft member 9. The lowermost end of the tubular shaft member 9 is received in the cylindrical cavity 8 through the opening 6 in the uppermost end of the outer body member 5. The free end of the tubular shaft member 9 comprises an internally threaded connector 10 to facilitate connection to a first section of drill pipe string (not shown), whilst the free end of the outer body member 5 comprises an externally threaded connector 11 around the opening 7 to facilitate connection to a second section of drill pipe string (not shown). By virtue of the through path defined in the torque isolation mechanism between the connectors 10 and 11, cleaning fluid in the first section of drill pipe string is able to pass through it freely into the second section. Thus, inclusion of the torque isolation mechanism in the drill pipe string does not impede its normal operation.

The cylindrical cavity 8 comprises a first section 12, immediately adjacent to the end opening 6 through which the tubular shaft member 9 extends, the inner surface of

which defines a plurality of axially extending internal splines 13 and, beyond this first section 12, a second section 14 connected to the first by a radially outwardly extending lip 15 so that it is of greater diameter than the first.

5 The very end of the tubular shaft member 9 defines a radially enlarged head section 16, the diameter of which matches that of the second section 14 of the cylindrical cavity 8. The enlarged head section 16 ensures that the shaft member 9 cannot be withdrawn from the cylindrical cavity 8 through the end opening 6. However, the shaft member 9 is movable axially relative to the outer body member 5 between the radially extending lip 15 and the end face of the cylindrical cavity in which the opening 7 is located. A plurality of O-rings are provided between the outer circumferential surface of the head section 16 and the inner wall of the second section to form a fluid tight seal therebetween. Immediately adjacent to the head section 16 on the shaft member 9 are a plurality of axially extending external splines 17, the width and spacing of which are such that they match with the internal splines 13 in the wall of the first section of the cylindrical cavity 8.

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It will be understood that when the shaft member 9 is withdrawn to its fullest extent from the outer body 5, the internal and external splines 13 and 17 are caused to engage, thereby locking the outer body 5 to the shaft member 9 and preventing one from rotating relative to the other. However, when the shaft member 9 is inserted into the outer body so that the external splines 17 carried thereby lie beyond the internal splines 13 in the cylindrical cavity 8, each is able to rotate freely relative to the other.

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In use, the torque isolation mechanism is inserted between two sections of drill

pipe string with outer body member 5 connected to the lowermost section thereof and the shaft member 9 connected to the uppermost section thereof. Unsupported, the weight of the lowermost section causes the outer body member 5 and the shaft member 9 to separate to their fullest possible extent, thus causing the internal and external splines 13 and 17 to engage. In this mode the uppermost section of drill pipe string is rotatably linked to the lowermost.

However, if the drill pipe string is lowered far enough into a well bore for the lowermost section thereof to be supported on the well bottom, or otherwise, the outer body member 5 also comes to rest. Now, if the uppermost section is lowered still further the shaft member 9 moves from the upper end of the cylindrical cavity 8 to the lower end and the internal and external splines 13 and 17 become disengaged. At this point the shaft member 9 and the section of drill pipe string connected to it is able to rotate relative to everything below it.

To facilitate free rotation of the shaft member 9 relative to the outer body member 5 a thrust race 19 is provided on the upper end of the outer body member 5 against which downwardly facing surface 20 on the shaft member 9 rests when this reaches its lowermost position within the cylindrical cavity 8.

In order to reconnect the two sections of drill pipe string the upper section is simply lifted to cause the torque isolation mechanism to take the full weight of the lowermost section again and to bring the internal and external splines 13 and 17 back into engagement with each other.

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CLAIMS

1. A torque isolation mechanism having a first end and a second end, each adopted, in use, to be connected to one end of a respective section of drill pipe string, and  
5 a through bore extending between the first end and the second end, wherein a clutch mechanism is provided between the said first and second ends, whereby when the clutch mechanism is engaged the said ends are rotatably connected together and when the clutch mechanism is disengaged the said ends are rotatably disconnected from each other such that each section of drill pipe string is isolated from the other and free to rotate  
10 independently thereof.

2. A torque isolation mechanism according to claim 1, wherein the clutch mechanism comprises an outer body member having a cylindrical cavity therein and openings at each end of the cavity, and a tubular shaft member one end of which is coaxially received within the said cylindrical cavity through one of the said end openings,  
15 wherein mutually engageable locking members are provided on the inner surface of the said cylindrical cavity and on the outer surface of the inner end of the said tubular shaft, and wherein the tubular shaft member is slidable axially within the said cylindrical cavity between a first position in which the said locking members are engaged, thereby preventing rotation of the outer body member relative to the tubular shaft member, and  
20 a second axially removed position in which the locking members are disengaged, thereby enabling the outer body member to rotate relative to the tubular shaft member.

3. A torque isolation mechanism according to claim 2, wherein the said

mutually engageable locking members comprise internal and external axially extending splines.

4. A torque isolation mechanism according to claim 2 or 3, wherein the inner surface of the said cylindrical cavity defines a radially outwardly extending lip against which a radially outwardly extending surface of the said shaft member engages to retain the shaft member in the said cylindrical cavity.

5. A torque isolation mechanism according to claim 2, 3 or 4, wherein a sealing member, for example, O-rings, is provided between the said shaft member and the said cylindrical cavity to prevent cleaning fluid leaking past the shaft member and out of the opening in the said outer body member in which it is received.

6. A torque isolation mechanism according to any preceding claim, wherein the free end of the shaft member and of the outer body member is each adapted for connection to the end of a respective section of drill pipe string.

7. A torque isolation mechanism according to any preceding claim, further comprising a thrust race on which the uppermost part thereof rests when the clutch mechanism is in the second disengaged position which serves to facilitate relative rotation of the two parts of the clutch mechanism.

8. A torque isolation mechanism substantially as hereinbefore described with reference to the accompanying drawings.

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INVESTOR IN PEOPLE

Application No: GB 0127222.8  
Claims searched: 1-8

Examiner: Andrew Hughes  
Date of search: 24 July 2002

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK CI (Ed.T): E1F FAC  
Int CI (Ed.7): E21B 17/00, 17/02, 17/04, 17/042, 17/043, 17/046, 17/05, 17/06  
Other: Online: EPODOC, WPI & JAPIO

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	GB 2287731 A (DEN NORSKE STATS OLJESELSKAP) whole document	7
A	EP 0624709 A2 (SOFITECH)	
X, Y	WO 2001/049967 A1 (DEN NORSKE STATS OLJESELSKAP) whole document	X: 1-3, 5, 6 Y: 7
X, Y	WO 2001/029373 A1 (SHELL) whole document	X: 1, 6 Y: 7
A	US 6241032 B1 (FALGOUT Sr.)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.